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NOTES ON A MIGRATION OF *LIBYTHEA BACHMANNI* KIRTL.

BY CHARLES H. GABLE and W. A. BAKER,

Bureau of Entomology, U. S. Department of Agriculture.

The first individuals of a migration flight of the butterfly, *Libythea bachmanni* Kirtl., were observed by W. A. Baker passing the Field Laboratory, Cereal and Forage Insects, San Antonio, Texas, at two o'clock p.m., September 26, 1921. The butterflies increased so rapidly in numbers that it was decided to determine the extent of the migration and gather such other information as might prove of interest.

Personal investigation aided by reports from every part of South Texas indicated that the butterflies were advancing on a front extending from a point fifty miles north of San Antonio due south to the Rio Grande River, a distance of approximately two hundred and fifty miles. Careful tests indicated that the average flight was four and one-half miles per hour, and, in the vicinity of San Antonio, the estimated number of butterflies passing per minute over each rod of front during the hours of flight was seventeen. Since the flight was very uniform along the entire front, this would mean that approximately one and one-quarter million butterflies were passing a line at right angles to their line of flight each minute.

The direction of flight was slightly south of east at all times. The prevailing wind was from the south or east of south, but usually was not strong enough to affect the direction of flight. There was a stiff breeze from the north-east in the forenoon of September 30. During this time the butterflies were travelling very high in the air, some of them at an altitude of over a hundred feet, and could barely be seen. It is possible that others were still higher. They seemed to seek higher altitudes in an effort to overcome the obstruction of the wind. This inclination was also noted where obstructions such as buildings and trees were encountered. In each case the butterflies ascended to such height as enabled them to go over the obstruction, and never around it. The direction of the wind did not seem to materially alter the original direction of flight since it was noted that, although the butterflies were advancing in a more southerly direction, each individual was facing its original direction of south of east and was attempting to make headway in that direction.

The flight at San Antonio continued with uniform intensity for eighteen days, after which the numbers gradually diminished, although some specimens were noted in timbered sections until the first freeze, December 5.

The forward movement was continued until they arrived within about thirty miles of the coast. There occurred a considerable banking up or accumu-

lation of individuals for several days on a front parallel to the coast line after which they seemed to turn back to the west. They, however, did not proceed in this new direction except for a short distance, but seemed to lose their inclination for a definite line of flight and wandered aimlessly about the country.

The butterflies fed freely on many flowers such as Rock Brush (*Eysenhardtia amorphoides* H. B. K.), Madeira vine, and a considerable number of other plants in bloom at that time. Water, whether in a creek, stagnant pool or merely moist ground, exerted a very strong attraction and caused the butterflies to congregate in swarms. They appeared in large numbers in cotton fields attacked by the cotton worm (*Alabama argillacea*) where they seemed to be feeding on the plant juices exuding from the edges of the leaves cut by the worms.

The females for the most part were gravid, but observations failed to note oviposition on any plants in the vicinity of San Antonio with the exception of one observation by H. B. Parks, who stated that he noted a female ovipositing on *Hymenopappus artemisiaefolius* D. C., which is rather a common weed throughout Texas. Unfortunately, we were unable to relocate the eggs for hatching purposes, nor was it possible to find other eggs in the same locality, although butterflies were present in abundance. One female oviposited in a cage and the eggs hatched, but the proper food for the larvae was not found.

One of the butterflies was caught in a net and whirled rapidly about the head twenty-five times in a horizontal plane, the object being to determine if the sense of direction could be affected. When released, the butterfly immediately took the original line of flight. The same experiment was made whirling the net about in a vertical plane at right angles to the line of flight; also in a plane in the same line as the line of flight, with the same results as in the first experiment. The number of revolutions was then increased to fifty and the experiments repeated with the same results. The experiment was then made of whirling the net fifty times in a horizontal plane and fifty in a vertical plane at right angles to the line of flight, the same insect being used. When released, the butterfly immediately resumed its original line of flight. Two of the specimens had lost their palpi and were otherwise rubbed. One specimen alighted on a plant after travelling about fifty feet, but when disturbed, it resumed its flight and continued until lost from sight in the distance.

As previously noted, when first observed the butterflies had already started their migration. This reason and the fact that the source of the migration was several hundred miles from San Antonio, where flight was first noted, of necessity prevents any definite proof of the breeding place of these insects. However, from data obtained from all parts of area covered and from observations as to direction of flight, it may be stated at this time that the probable breeding place is somewhere in the so-called "Big Bend" country of North Mexico directly west of South Texas.

The territory ultimately covered was that portion of Texas south of a line starting fifty miles northwest of the mouth of the Pecos River; extending almost due east to a point sixty miles north of San Antonio; thence southeast to within thirty miles of the coast; and north to the Rio Grande River, paralleling the coast line.

THE NORTH AMERICAN SPECIES OF PHYLLOXERA INFESTING
OAK AND CHESTNUT. (HEMIPTERA: PHYLLOXERIDAE)

BY CARL D. DUNCAN,

Stanford University, California.

The present paper is based upon a study of five species of *Phylloxera* that are certainly new, a sixth that is probably new and four described species.

The writer is indebted to Mr. W. M. Davidson of the United States Bureau of Entomology for the collection of one of the new species, to Professor R. W. Doane of Stanford University for one, and to Professor G. F. Ferris of Stanford University for two. Dr. A. C. Baker of the Bureau of Entomology has very kindly lent material of *P. rileyi*, *P. querceti* and *P. castaneae* from the National Collection. To each of the above gentlemen the author expresses his sincere thanks. They are especially due to Professor G. F. Ferris because of his enthusiastic encouragement and helpful criticism and many suggestions during the preparation of this paper. He also mounted most of the specimens except those lent by Mr. Davidson and Dr. Baker.

The one thing above all that the present bit of work has made plain to the writer is the extent to which the American species of *Phylloxera*, particularly those infesting oaks, need study. Until 1919 but two American, oak-infesting species were known. In that year Ferris described *P. stanfordiana* and until the present these three species have been all that have been known from our oaks. The species here described as new have been discovered almost purely through accident and it appears probable that a thorough examination of our various oaks will increase the list several fold. Several of the species, even if not at present of economic importance, may in time become so, and it is hoped that this paper may serve to stimulate observers to look for and collect these interesting insects.

A word as to the preparation of specimens for study may not be amiss. One should not hope to obtain satisfactory specimens by mounting them directly in balsam, as such specimens shrink, the legs double up beneath them, and many of the details of structure which are of specific importance are likely to be obscured. The material upon which Pergande based his descriptions was prepared in this manner, and from its condition it is surprising that he was able to accomplish anything with it. As it is, his work leaves much to be desired.

Specimens should at least be passed through ninety-five per cent. alcohol and cleared in carbol-xylene or some other clearing medium before being put into the balsam. A still better method, however, is that of clearing the specimens in caustic potash and staining with magenta in the manner that is now generally followed in the preparation of Coccidae and similar small insects. This method gives excellent preparations which well repay the small amount of effort expended in securing them. All the structures are plainly visible, not being obscured by the body contents. Specimens so treated straighten out much better also.

GENERAL MORPHOLOGY.

The alate forms of but three species, *P. rileyi*, *P. castaneae*, and *P. davidsoni* have been available to the author. These show but little variation and give

but little promise, except in the antennae, of furnishing characters for separating the species. Further study of material including a larger number of species may disclose usable characters, but this at present seems unlikely. A figure of the alate form of *P. castaneae* is appended to this paper and will give an idea of the general features of this form. The antenna of this species differs from that of *P. rileyi* and *P. davidsoni* in that the third segment bears but one large sensorium instead of two.

The best—if not only—reliable characters for separating the species are to be found in the apterous agamic females. The descriptions and figures given in this paper are based almost entirely on this form. The figures are from reconstructed camera lucida drawings, except that of the ovipositor, which is free-hand, and all were made by the author. The figures are not drawn to a uniform scale, but since the specific characters depend upon the relative proportions of the different parts of the same insect, this condition does not interfere with their usefulness. Figures of *P. rileyi*, *P. querceti* and *P. castaneae* are included to supplement the rather unsatisfactory figures given by Pergande in his paper of 1904.

The apterous agamic females of the group, which may be called the *P. rileyi* group, to which the species herein described belong, are characterized by the development in greater or less degree of tubercles on the dorsum. These are arranged in a very definite and constant fundamental pattern, there being six rows, one on each lateral margin extending the full length of the body, one of similar extent on each side of the median line, and a thoracic row of but three tubercles interpolated between the submedian and lateral rows on each side. The tubercles are longest on the posterior part of the thorax, shorter on the head and much reduced or even obsolete on the posterior part of the abdomen. When they are obsolete their positions are still marked by small setae. They vary in size in the different species from very tiny elevations, which scarcely deserve to be called tubercles in *P. stanfordiana*, to very conspicuous, elongated processes which in *P. rileyi* nearly equal the antennae in length. Each tubercle is provided at the apex with a stout, parallel-sided seta with a somewhat mushroom-shaped apex. These setae are practically equal in length on all the tubercles of a single specimen.

In addition to this, the tubercles are provided with secondary roughenings in the form of tiny chitinous points or spines which are usually larger toward the base of the tubercles and which may be spirally arranged around the tubercle or unevenly distributed. In most of the species there are four relatively stout secondary spines surrounding the seta at the apex of the tubercle. There are no pore areas such as are characteristic of the genus *Phylloxera*.

The integument is generally roughened in some manner, usually by the presence of slight wrinkles, which may give it a reticulated appearance, or by innumerable chitinous points or by minute pits. These roughenings are of aid in making specific determinations.

There are but two pairs of spiracles, the thoracic ones, those of the abdomen apparently being entirely absent.

The antennae are three-segmented, the third segment being irregularly annulated and bearing just below the tip a large, oval sensorium and from two to four very small secondary sensoria, which are frequently difficult to see, along

the margin of the primary sensorium. Figures of the antennae are given, though only in exceptional cases are they referred to in the descriptions, since they appear only rarely to offer characters of specific value.

The beak varies considerably in length and in the number of apparent segments. Whether these divisions represent true segments is not evident from the material at hand, but they are definitely marked and are of some value in making determinations.

The legs, though annulated in some species and not in others, show very little variation and present no reliable specific characters.

The body is pyriform and shows but little segmentation, at least in mounted specimens, except on the abdomen where there is occasionally an indication of the posterior segments.

The position of the eye is somewhat variable. It is shown in the accompanying figures as being on the dorsum in some species and the venter in others. This difference is of significance and is due to the manner in which the specimens are flattened out on the slide which again depends upon the degree to which the living insect was distended.

The presence on the apex of the abdomen (Plate 10, fig. 2) of a pair of small, chitinous structures resembling a pair of approximated rods and functioning probably as an ovipositor will distinguish the mature females, either apterous or alate, from immature forms.

SPECIFIC DESCRIPTIONS.

The only characters given in the following descriptions are those which are of value in making specific determinations. For all other characters the section on general morphology may be consulted.

Phylloxera stellata new species.

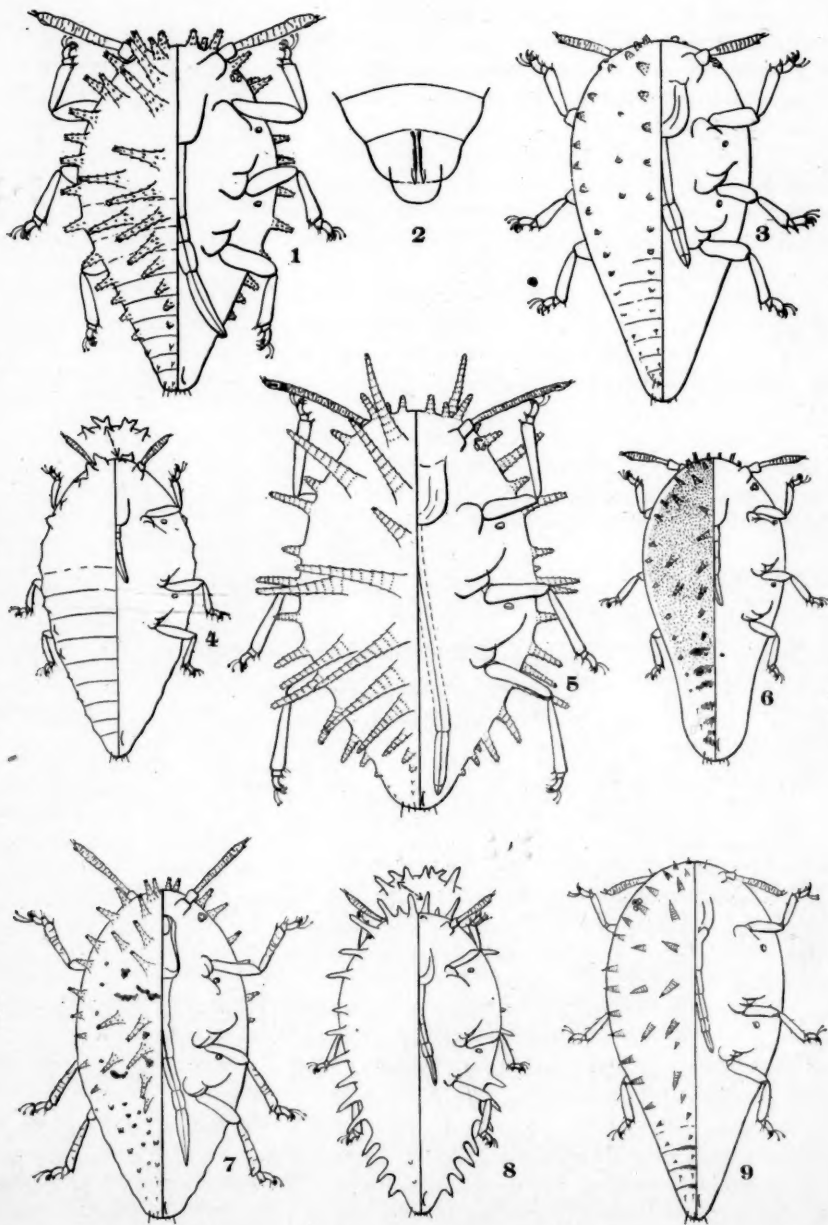
Plate 11, figs. 2, 8, 15, 25.

Apterous female (Plate 11, fig. 8). Length of type (flattened on slide) .45 mm. Tubercles (Plate 11, fig. 2) large, more or less globular, each supplied with a number of knob-like secondary projections and small spines, giving a stellate appearance, whence the name. Derm with a minute reticulation formed by tiny chitinized wrinkles and spines which is difficult to see except in well stained specimens and is in any case best developed on the head and thorax. Beak three-segmented, attaining the hind coxae. Legs (Plate 11, fig. 15) rather stout, the tibia annulated, the annulations, however, appearing indistinct on lightly stained specimens.

Type Host and Locality. From an oak which appears to be either *Quercus margaretta* or *Q. alba*, Dallas, Texas, Aug. 17, 1921, G. F. Ferris.

Holotype and Paratypes in the Stanford University collection and a paratype slide in the National Collection.

Notes. This is the most distinctive species of the group, as none other has the stellate type of tubercles. No alate specimens were secured. The apterae occur thickly distributed over the under surfaces of the leaves and each produces a small, brown, discolored area, so that the leaves have a speckled appearance. No distortion of the leaves occurs. The illustrations, except figure 15 of Plate 11, are from the holotype.



NORTH AMERICAN SPECIES OF PHYLLOXERA.

Phylloxera reticulata new species.

Plate 10, fig. 9; Plate 11, figs. 11, 12, 24.

Apterous female (Plate 10, fig. 9). Length of type (flattened on slide) .75 mm. Tubercles (Plate 11, fig. 11) prominent, elongate conical, provided with very many tiny, spine-like points which are arranged spirally from base to apex. Length of apical setae five or six times its diameter, much greater relatively than the apical setae on any of the other species here described. Eighth tubercle of each of the sub-median rows much shorter than either the seventh or the ninth. Derm (Plate 11, fig. 11) minutely wrinkled, the wrinkles chitinized and forming a finely reticulated pattern much as in *P. stellata*, these reticulations not evident posteriorly on the abdomen. Posterior abdominal tergites slightly chitinized. Beak four-segmented, attaining or slightly exceeding the hind coxae. Legs with the annulations faintly or not at all evident.

Type Host and Locality. From *Quercus kelloggii*, Jasper Ridge near Stanford University, California, October 11, 1921. Collected by the author.

Holotype and Paratypes in the Stanford University collection and a paratype slide in the National Collection.

Notes. Apterae only were found. These were present scatteringly along the veins on the under surface of the leaves on a single tree. A search of other trees in the immediate vicinity yielded no additional material. Eggs and developing young in all stages were present, all being bright orange yellow in color, the adults having the eyes reddish. Eggs oval; shortly before hatching they present a reticulated appearance and the eyes of the embryos show through.

The character of the secondary spines on the tubercles will distinguish this from all other species except *P. rileyi* and *P. castaneae*, which, however, are easily distinguishable by the exceedingly long tubercles in the case of the former and the apparent lack of dorsal tubercles in the case of the latter.

Phylloxera davidsoni new species.

Plate 10, fig. 7; Plate 11, figs. 6, 19, 26.

Apterous female (Plate 10, fig. 7). Length of type (flattened on slide) .73 mm. Tubercles (Plate 11, fig. 6) prominent, elongate conical, the longest about two thirds as long as the hind femora, provided with secondary spines which are prominent and stout at the base of the tubercle and become smaller toward its apex, armed at the apex with four prominent spines which surround the apical seta. Derm minutely roughened (Plate 11, fig. 6) with relatively broad, low, more or less wart-like, minute protuberances which may or may not be provided with chitinous points. Dorsum with a number of internal, chitinous (?), rounded, oval or beaded structures which show a fairly close bilaterally symmetrical arrangement. In Plate 11, fig. 7, these are indicated by stippled areas. Beak five-segmented, attaining a point two thirds of the distance from the hind coxae to the tip of the abdomen. Legs annulated, relatively longer and more slender than in *stellata*.

Type Host and Locality. From *Quercus engelmanni*, Alhambra, Los Angeles County, California, November 7, 1919. Collected by Mr. W. M. Davidson.

Holotype. In the Stanford University collection; one slide of paratypes in the National Collection; remainder returned to Mr. Davidson.

Notes. The following are extracts from Mr. Davidson's notes. "On the lower surface of tomentous young foliage; alates, apterae and eggs collected. Eggs are short oval, pale yellow when deposited, becoming darker as incubation proceeds. Shortly before the larva hatches the eye spots are visible and the chorion assumes an appearance as though embossed with hexagonal elevations. Larva is pyriform, light yellow, with blackish spines. Apterae from light orange to yellowish brown, appendages dusky yellowish-gray. Beak of young larva reaches beyond apex of abdomen. Alates orange with black thorax and mesosternum. Antennae of young larvae relatively long, the distal joint longer than the hind tibia."

The accompanying drawings were made from the holotype.

***Phylloxera similans* new species.**

Plate 10, fig. 6; Plate 11, figs. 3, 13, 23.

Apterous female (Plate 10, fig. 6). Length of type (flattened on slide) .7 mm. Tubercles (Plate 11, fig. 3) moderately prominent, elongate conical, the longest, however, not longer than the tarsus, ornamented with secondary spines which are relatively stout and sharply pointed and are longest at the base of the tubercles; apex of the tubercles armed with four relatively stout spines surrounding the apical seta. Derm (Plate 11, fig. 13) of head and thorax and basal half of abdomen with exceedingly numerous, minute, heavily chitinized wrinkles and points. Beak four-segmented, not quite attaining the hind coxae. Abdominal tergites slightly chitinized. Legs without annulations.

Type Host and Locality. From "Bur oak," which is probably *Q. macrocarpa*, Staten Island, New York, summer 1917. Professor R. W. Doane.

One slide bearing holotype and three paratypes alate nymphs in the Stanford Collection.

Notes. This species is quite closely related to *P. davidsoni* of southern California. The difference in the character of the integument, the shorter tubercles with their relatively larger secondary spines and the shorter beak will separate it from the latter, however.

***Phylloxera tuberculifera* new species.**

Plate 10, fig. 3; Plate 11, figs. 7, 10, 27.

Apterous female (Plate 10, fig. 3). Length of type (flattened on slide) .5 mm. Tubercles (Plate 11, fig. 7) but little higher than broad, smaller than in any other known oak-infesting species except *P. stanfordiana*, armed with several small secondary spines and surmounted by the usual seta. Derm (Plate 11, fig. 10) with minute wrinkles and points, these being so chitinized as to give an appearance of short, disconnected, irregular lines. Beak four-segmented, slightly exceeding the hind coxae.

Type Host and Locality. From what appears to be *Quercus havardii*, the "shinnery oak," on the edge of the Staked Plains near Quitaque, Texas, August 23, 1921. Collected by G. F. Ferris.

Holotype and Paratypes in the Stanford University collection.

Notes. Apterae only were collected. They occur thickly scattered over the under surface of the leaves. The injury resulting from their feeding produces a multitude of tiny brownish spots.

Phylloxera querceti Pergande.

Plate 10, fig. 1; Plate 11, figs. 4, 17, 21.

1904. *Phylloxera querceti* Pergande, Proc. Davenport Acad. Sci. 9: 263-5; plate 20.

Apterous female (Plate 10, fig. 1). Length flattened on slide) .45 mm. Derm minutely roughened, the condition of the specimens on the slides at hand, however not being such as to enable me to determine the nature of this roughening. Tubercles (Plate 11, fig. 4) prominent, elongate conical, the longest nearly if not quite as long as the femora, provided with many relatively stout and sharp secondary spines and terminating in four sharp spines surrounding the apical seta. Beak four-segmented, relatively long, though not quite attaining the tip of the abdomen. Legs stoutish, apparently without annulations.

Type Host and Locality. From *Quercus alba, macrocarpa, panonia* and *daimio*, Washington, D. C., according to Pergande.

Notes. The specimen figured is from the National Museum material lent by Dr. Baker. The slide bears the following notation, "47|22. Phylloxera on *Q. macrocarpa*. D. C. Aug. 20, '83" The slide bears three cover glasses, under the middle one of which, indicated by a ring of ink, is the specimen figured. As this specimen was undoubtedly in Pergande's hands when his description of the species was drawn up, it may be designated as the lectotype.

The material received from Dr. Baker contains also four other slides, labeled as *P. rileyi* and bearing the notations, $372 \times 47|25$; $372 \times 47|18$; $372 \times 47|19$; $372 \times 65|18$, which I believe likewise to represent *P. querceti*.

This species is closely related to *P. davidsoni* from which it may easily be distinguished by the markedly longer tubercles and the stouter and non-annulated legs.

Phylloxera rileyi Riley.

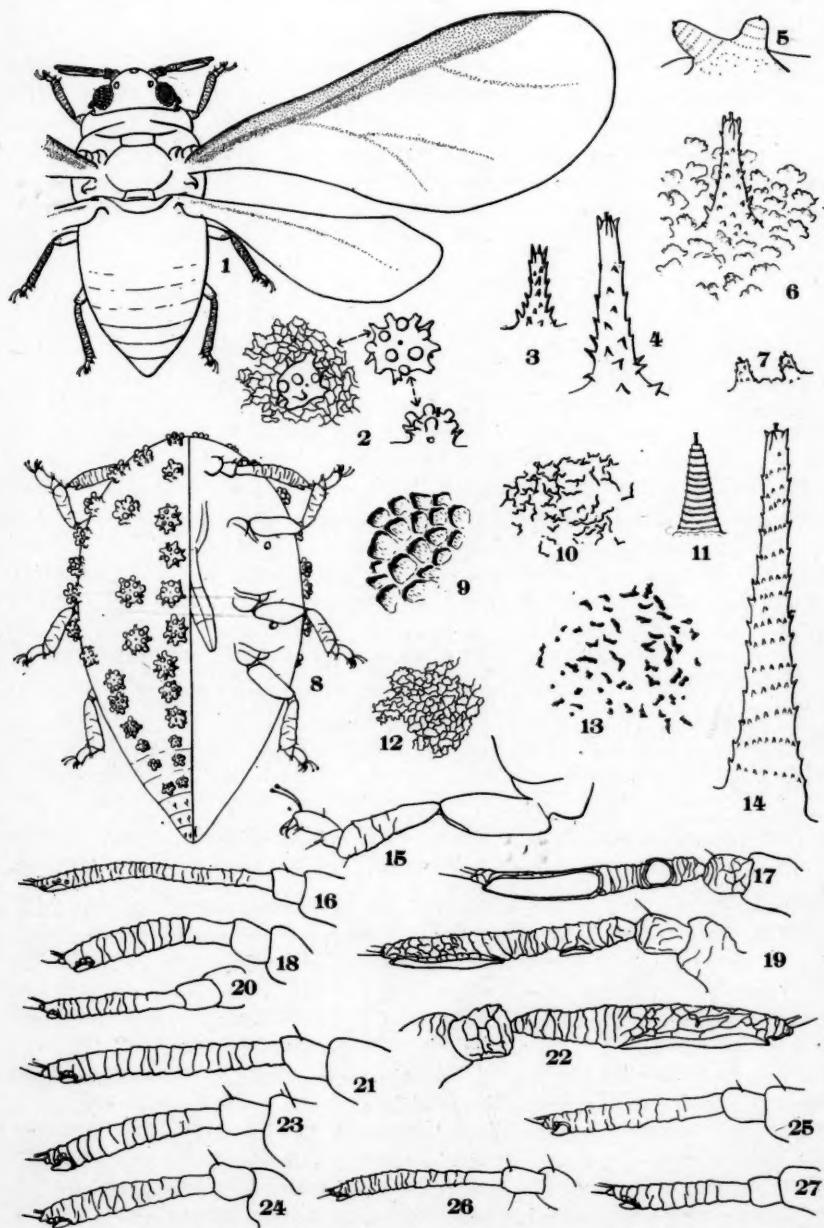
Plate 10, fig. 5; Plate 11, figs. 9, 14, 16.

1874 *Phylloxera rileyi* Lichtenstein, Riley, Missouri Report 6: 64-5; figs. 18, 19.1875. *Phylloxera rileyi* Licht., Riley, Missouri Report 7: 118-121; fig. 22.1875. *Phylloxera rileyi* Licht., Comptes Rendus de Séances de L'Academie des Sciences, p. 1223. (without description).1875. *Phylloxera rileyi* Licht., Stet. Ent. Zeit., p. 359. (without description).1904. *Phylloxera rileyi* Riley (Licht. mss.), Pergande, Proc. Davenport Acad. Sci. 9: 261-3; pl. 19.

Apterous female (Plate 10, fig. 5). So-called "black form." Length (flattened on slide) .6 mm. Tubercles (Plate 11, fig. 14) very conspicuous, the longest as long as the third antennal segment, provided with exceedingly numerous points arranged in a spiral, and terminating in four relatively stout and sharp secondary spines which surround the apical seta. Derm (Plate 11, fig. 9) roughened by the numerous pits which produce a tessellated appearance. Beak long, attaining the tip of the abdomen. Antennae (Plate 11, fig. 16) and legs unusually long and slender, the latter without annulations.

Type Host and Locality. Riley records it merely from "white oak" and "post oak" without any statement as to locality. According to Pergande (1904) it was taken from *Quercus alba* and *Q. obtusiloba* near Kirkwood, Missouri.

Notes. In the material received from the National Collection there is a single slide mount of three specimens of the so-called "black form," which according to Pergande is the true adult, apterous agamic female of the species.



NORTH AMERICAN SPECIES OF PHYLLOXERA.

The slide at hand is apparently that from which Pergande made his description and figures and it is upon this that the description and figures given here are based. It bears the notation, "372 x 47|2 1:1 1|42. Rileyi. Black female and eggs from winged female."

Of the twenty eight slides received from the National Collection and labeled as *P. rileyi* on their envelopes, one bears the notation "P. quercus? France?" on the slide itself and is obviously not *P. rileyi*; four bear specimens that the author considers to be *P. querceti*; three bear specimens the identity of which is doubtful, the tubercles being practically obsolete; one, labeled "Phylloxera n. sp.?" bears a single larva which resembles the form with obsolete tubercles; six contain specimens of what is apparently the so-called "light form" of *P. rileyi*. These agree quite closely with the specimens of the "black form," differing in but minor details, so their identity does not seem to be open to question. Field observations, however, will be necessary before the actual relationship of the "black" and "light" forms can be definitely determined.

Thirteen of the slides contain specimens the identity of which it is impossible to determine because of the condition of the preparations.

P. rileyi may be distinguished from all the other species by the exceedingly long tubercles ornamented with a spiral of minute secondary spines.

Phylloxera stanfordiana Ferris.

1919. *Phylloxera stanfordiana* Ferris, Ent. News 30: 103; fig.

Notes. Since this species was described it has not been rediscovered and there is nothing to add to the original description.

Phylloxera castaneae Haldeman.

Plate 10, figs. 4, 8; Plate 11, figs. 1, 5, 18, 20, 22.

1850 *Chermes castaneae* Haldeman, Am. Jn. Sci. and Arts, (2). 9: 108.

1859. *Phylloxera ? castaneae* (Hald.). Fitch. Third Rept. Noxious Ins. New York, p. 472

1904. *Phylloxera castaneae* (Hald.) Pergande, Proc. Davenport Acad. Sci. 9: 257-61; pl. 18, figs. 143-50.

Apterous female. (Form with long tubercles, Plate 10, fig. 8). Length (flattened on slide) .75 mm. Tubercles (Plate 11, fig. 5) present only along the margins of the body, well developed, the longest, however, only about three fourths the length of the femora, with exceedingly minute secondary spines and with the apical seta shorter than in any of the other species, it being but little more than twice as long as its own diameter. Derm with a shagreened surface. Beak four-segmented, nearly or quite attaining the hind coxae.

(Form with short tubercles, Plate 10, fig. 4). Differing from the above only in the shortness of the lateral tubercles which are almost obsolete in some specimens, though fairly well developed on the head, and in the shortness of the beak which attains or but slightly exceeds the hind coxae.

Alate female. Differing from the alates of *P. rileyi* and *P. davidsoni*, the only other species of which alates are available, in not having a constriction near the base of the third antennal segment (Plate 11, fig. 22) and in having but one large sensorium, the apical, on this segment.

Type Host and Locality. From *Castanea* in eastern United States.

Notes. The material examined is all from the National Collection and from the following hosts and localities: *Castanea vesca* and *C. pumila*, Washington, D. C.; *C. dentata*, Linglestown, Pennsylvania; "chestnut." Rockville and Annapolis Junction, Maryland.

Pergande suggests that the form with the long tubercles may be specifically distinct from the form with short tubercles. It will take further field studies to determine this point.

The nymphs of both forms have the dorsal tubercles developed but these are small and inconspicuous, being but little higher than broad.

Phylloxera sp.

Two slides from the National Collection, bearing the notation "Phylloxera castaneae Hald. No. Q. 13615 D. C. 8|31|17 Hst. chestnut, loc. Yarrow, Md., Coll. Dr. Galloway" contain alates of a species which is certainly not typical *P. castaneae* as they are much smaller and have the third antennal segment constricted somewhat as in *P. rileyi* and bearing two sensoria instead of one. The condition of the material and the absence of apterae, however, makes it inadvisable to describe the species.

EXPLANATION OF PLATES.

Plate 10.

Apterous agamic females of : 1-*Phylloxera querceti* Perg.; 3-*Phylloxera tuberculifera* n. sp.; 4-*Phylloxera castaneae* (Hald.), form with short tubercles, the small figure above showing a variation in the cephalic tubercles; 5-*Phylloxera rileyi* Riley; 6-*Phylloxera similans* n. sp.; 7-*Phylloxera davidsoni* n. sp.; 8-*Phylloxera castaneae* (Hald.), form with long tubercles, small figure above shows variation in cephalic tubercles; 9-*Phylloxera reticulata* n. sp. Fig. 2-ovipositor of *Phylloxera davidsoni* n. sp.

Plate 11.

Phylloxera castaneae (Hald.): 1-ate female of form with long tubercles; 5-tubercles of form with long tubercles; 18-antenna of apterous female, form with short tubercles; 20-antenna of apterous female, form with long tubercles; 22-antenna of alate female. *Phylloxera stellata* n. sp.; 2-details of tubercles and integument; 8-apterous female; 15-leg of apterous female; 25-antenna of apterous female. *Phylloxera similans* n. sp.: 3-tubercle; 13-details of integument; 23-antenna of apterous female. *Phylloxera querceti* Pergande: 4-tubercle; 17-antenna of alate; 21-antenna of apterous female. *Phylloxera davidsoni* n. sp.: 6-details of tubercle and integument; 19-antenna of alate female; 26-antenna of apterous female. *Phylloxera rileyi* Riley: 9-details of integument; 14-tubercle; 16-antenna of apterous female. *Phylloxera tuberculifera* n. sp.; 7-details of tubercles; 10-details of integument; 27-antenna of apterous female. *Phylloxera reticulata* n. sp.: 11-tubercle; 12-details of integument; 24-antenna of apterous female.

NEW DIPTERA IN THE CANADIAN NATIONAL COLLECTION*

BY C. HOWARD CURRAN,

Ottawa, Ont.

***Cyrtopogon willistoni* new species.**

Allied to *praepes* Williston but the first joint of the front tarsus is not silvery white pilose above.

Length, 11 to 16 mm. *Male*. Face strongly gibbose, convex-receding from a little below the antennae; moderately whitish-yellow pollinose; middle of face with tawny to yellow fine pile, bordered laterally with one or two rows of strong black hairs, all the hairs just above the oral opening stout and black. Front shining black in the middle, with a longitudinal groove, the sides yellow pollinose, the pile wholly black. Occiput black; black pilose, the immediate orbits wholly with a row of black hairs, the lower half with fine whitish yellow pile. Antennae wholly black, the basal segments with long black hairs; third joint longer than the basal two combined, coarctate basally, but wholly rather slender, its greatest width about the apical fourth or fifth; style one-fourth the length of the third joint, with a short, terminal spine-like process. The length of the antennae is about equal to the length of the face.

Thorax shining black, the 5 shaped brownish-yellow pollinose marking seldom complete, as the dash and lower portion is usually missing (usually present in large specimens, but not in the type); a slender or rather narrow median line on the anterior half of the same color and the posterior portion, when viewed from in front, with similar pollen. Pollen on the pleura similar in color to that on the dorsum; the scutellum with a richer colored pollen in certain lights, but generally appearing shining black. Pile moderately abundant, rather long, black; on the pleura chiefly yellowish, but almost all black on the meso- and sternopleura. Scutellum convex.

Legs black; hind tibiae sometimes quite reddish except the broad apex and very narrow base, at other times only slightly lighter in color on the basal two-thirds. Femora with rather abundant, long pale yellow pile, but behind, more or less, and apically, especially above, with black pile. Tibiae black pilose, the hind ones and sometimes the anterior four also, with yellow hairs in front. Anterior tibiae anteriorly and the hind ones on the apical fourth interiorly, golden tawny pubescent. Anterior tarsi with a long, silvery white crest on the last four joints, the hair parted anteriorly near the base, but not usually distinctly parted on the second joint; first joint black haired, rarely with just a few whitish hairs above before the apex; the last joint of the fore tarsus is longer than either the third or fourth, their ventral cushions tawny. Middle tarsi wholly black haired, the last two joints with anterior and posterior tufts of rather long hairs, the second and third with distinctly shorter tufts anteriorly, but the second may often be without the conspicuous tuft, the third joint usually has a small tuft behind; the fifth joint is nearly as long as the first. Hind tarsi simple; black pilose.

* Contribution from the Entomological Branch, Department of Agriculture, Ottawa.

Wings cinereous or luteous hyaline. Squamae brown or brownish, with broad yellow border and sparse whitish fringe. Halteres yellow, the stem more or less infuscated.

Abdomen shining black, without pollinose spots or bands. Pile black; on the sides of the first two segments and the posterior angles of the two or three following, with yellow pile; this gives the appearance of tufts laterally. Sometimes the first three segments are wholly yellow pilose on the sides.

Female. Mystax rarely as in the male, usually much more blackish as the strong black hairs are scattered throughout the yellow ones; front more shining, beard paler. Thorax with the pollen yellowish on the middle of the dorsum, greyish laterally, the median stripe broader, entire, the 5 complete, usually wholly closed so that it resembles a 6; posterior portion of the thorax with greyish white pollen. Legs wholly simple; similar in colour. First to fifth abdominal segments with a rounded triangular pollinose spot on the posterior angles, those on the fifth segment very small; the light coloured pile is usually less bright yellow.

Holotype, ♂, Chilcotin, British Columbia, June 16, 1920; (E. A. Buckell); No. 500, in the Canadian National Collection, Ottawa.

Allotype, ♀, Aspen Grove, B. C., June 28, 1922, (P. N. Vroom).

Paratypes, over 100 specimens from British Columbia and one specimen from Banff, Alberta.

Specimens were very kindly compared with the type specimens of *praepes* Will., in the Francis Huntington Snow Collection, University of Kansas, by Messrs. Wm. Brown and R. H. Beamer. Differences noted: In *praepes* the silvery pile extends to the base of the anterior basitarsi; the pad on the middle tarsi is limited to the last two segments. In *willistoni* there are seldom more than three or four short silvery hairs on the anterior basitarsi; the pad on the middle basitarsi always extends onto the third and possibly in good specimens onto the second tarsal joint.

This is the species described by Williston, (Trans. Am. Ent. Soc., XI, 12) immediately following *praepes*, but no name was applied. According to Brown and Beamer the specimens in the Snow Collection have been included under *praepes* as types, and there are altogether only four specimens. Including both species Williston had nine specimens when he drew up his descriptions, five of which were the present species, and it therefore seems probable that three of these are in other collections under the name *praepes*. Williston does not mention the pruinose spot on the sides of the fifth abdominal segment in *praepes* female, and says that the front tarsi in *praepes* are more slender than in the present species and the pollen on the thorax less extensive.

***Cyrtopogon albitarsis* new species.**

Abdomen with reddish yellow pile forming dense apical bands; third antennal segment red; anterior tibiae and tarsi with a posterior fringe of short, silvery hair.

Length 11 to 12 mm. *Male.* Face moderately gibbose, convex receding, the pile golden yellow, below, and up the sides to the middle, stouter, black; ground colour obscured by pale yellowish pollen. Front yellow pollinose; wholly

black pilose. First two antennal joints black, with black hairs; third joint reddish yellow, constricted slightly just beyond the base; longer than the two basal segments combined, broadest about its middle; style usually black, but the base may be yellow. Occiput greyish yellow pollinose, black pilose; beard white, well separated from the eyes.

Thorax with a very conspicuous greyish yellow pollinose 5 on either side, the enclosed portion deep shining black, the margin behind the suture and a triangular projection inside the post-alar callus, also shining, elsewhere with greyish yellow or yellow pollen, the median line narrowly greyish in front on either side of which is a broader grey stripe; or the anterior curve of the five and the median geminate stripes may be ashy. Pleura yellowish grey pollinose. Pile black; on the propleura white, or the epipleura mixed black and golden. Scutellum convex with a golden brownish pubescence in some lights; pile black.

Femora all black, the apices narrowly yellow; pile black above, not very abundant, pale yellow below and behind. Tibiae reddish, the anterior ones paler, immediate base and apice black or blackish, anterior ones with moderately long silvery white pile posteriorly, short yellow pile anteriorly; a few black bristles exteriorly, several slender ones below anteriorly near the base and three below posteriorly, some of which may be reddish. Middle tibiae with silvery white pile in front and exteriorly, yellow pile elsewhere; with numerous black bristles. Hind tibiae wholly black pilose, the end below golden pubescent. Anterior tarsi yellow, with silvery pile which forms a dense fringe posteriorly; on the basal two segments the pile is bright yellow anteriorly. Pile all white on middle tarsi, which are darker than the anterior ones but paler than their tibiae. Hind tarsi with black hairs, in colour, similar to the middle tibiae.

Wings sometimes slightly tinged with luteous apically. Squamae fuscous with whitish border and fringe.

Abdomen black; second, third and fourth segments each with a posterior silvery greyish pollinose band, which appears yellow beneath the pile. First four segments reddish or tawny pilose, sparser and shorter anteriorly so that the pile appears in broad bands. Fifth, sixth and seventh segments triangular when viewed from behind, black pilose: with a narrow transverse band of short black pile about their middle dorsally, the last one or two segments with a steel blue reflection on the "keel." Hypopygium black; with a conspicuous fringe of black hairs sub-basally.

Holotype, ♂, Banff, Alta., July 17, 1916, (C. G. Hewitt); No. 501, in the Canadian National Collection, Ottawa.

Paratype. ♂, Banff, Alta., July 23, 1909, (N. B. Sanson).

***Odontomyia alberta* new species.**

Allied to *cincta*, but the branch of the third vein is at the apical fourth and not just beyond the middle; the frontal triangle is larger and black; abdominal crossbands shorter and scutellum broadly black basally in the middle; femora black apically; female with similar abdominal markings; front black, yellow just above the antennae; with a yellow oval spot on either side about the middle and sometimes two smaller spots between them; immediate vertex usually yellow, at least with two small spots.

Length 11 to 14 mm. *Male*. Face and cheeks pallidly green or yellow; above with four short forks of black extending from the black about the base of the antennae; the lateral forks along the orbits the median at either side of the rounded carina; sometimes more or less diffuse shining brownish in the middle of the upper half. Carina broader above, rather flat, face receding, only a little more prominent above than at the antennae. Frontal triangle shining black with a bluish cast, with a yellow, narrow longitudinal groove. Pile of face and front moderately abundant, fine, whitish. Vertical triangle shining black, dull in front; ocelli whitish; with short rather tawny pile, pile of vertex longer, yellowish or whitish. Occiput black above, not visible from above on either side of the vertex as the eyes extend back and down; below concolorous with the face; below with rather silvery pubescence directed towards the eyes. Antennae black, second and third segments opaque brownish with numerous round black areas; sometimes the apices of the first two joints and base of the second and third obscure luteous; first joint longer than the second; first anulus about as long as the first joint; third joint pointed apically. Facets of the eyes enlarged from a line about the length of the first antennal joint below the base of the antennae.

Dorsum of thorax shining blue black, the sides more bronze black in some lights; pile rather tawny but appearing whitish in most lights; postalar calli, usually extending almost to the roots of the wings, yellow or green; pleura greenish or yellow, with pallidly yellowish pile; pectus black, the black extending as a lobe onto the lower part of the mesopleura; scutellum concolorous with the thorax; the margin not reaching the basal angles, yellow or green, this colour somewhat expanded sub-basally; spines long, their bases yellow, apical half brown. Pile on the sides of the scutellum, bright yellow; elsewhere whitish.

Femora yellow or greenish; the apical half of the anterior four black; their apices reddish; apical third of the hind ones reddish brown; coxae green; tibiae black, the basal fourth yellow; tarsi brown.

Wings hyaline; veins brownish yellow; thin veins almost hyaline; cross-vein in the apical portion of the submarginal cell, situated at the apical fourth. Squamae white, with white fringe; upper lobe a little infuscated. Halteres with apple green knob, the basal half of the stem fuscous.

Abdomen subopaque steel blue; or often almost opaque black, with the fifth segment largely shining; sides of the first segment rather broadly, broad, rounded triangles on the second segment, resting on the hind margin, their inner ends narrowly separated from the margin, and in front separated from the lateral margin by the same distance as the green on first segment; slightly less broad markings on the third segment, their anterior margin not quite, or quite, reaching the margin inside the anterior angles; small rather truncate, longitudinal spots inside the posterior angles of the fourth segment and the conspicuous margin of the fifth, green or yellow; the margin of the fourth segment on the posterior two-thirds is green and is connected posteriorly with the green spot; the third segment may be said to be green laterally, more broadly so behind, with a blackish spot inside or almost upon the anterior angles, which stretches inwards, often to meet the black ground colour. When visible the sixth segment is green with a black arch in the middle, its curve caudad. Pile short on the disc, rather tawny;

a conspicuous patch of pile on the fifth segment, laterally; basal pile of abdomen longer, and paler; venter wholly green or yellow, with short rather silvery pile.

Female. Very similar to the male. Face yellowish; about the antennae with a roundish blackish area which emits a blackish stripe towards the orbits on either side; above the antennae narrowly yellowish; above which the ground colour is shining black; an oval spot on the orbits about the middle, a smaller spot inside these and a pair of spots on the vertex, never reaching the yellow orbits but often contiguous at the middle, yellow; sometimes all these spots small and the inner ones on the front wanting. The ocellar triangle is situated in a distinct depression and the median groove is deep. Occiput yellow to the upper angles of the eyes.

Thorax with the sides yellow or green, always a projection just behind the humeri and an elongate one along the lateral suture in front of the dorsal suture. The black of the pectus does not extend onto the mesopleura, but there may be an irregular brownish patch below. Scutellum usually all green or yellow except the base, which emits a rounded projection caudad at the middle; spines wholly greenish or yellow but the tips may be fuscous.

Abdominal spots all smaller; those on the first segment wider posteriorly; on the second narrower anteriorly, the posterior projection quite angular and occupying about one-fourth the width of the segment; spots on the third segment occupying a little over the posterior half at the widest portion; about one-half at the margin, the inner end angular; spots on fourth segment smaller, occupying about one-third the length of the segment. On the third and fourth segments the lateral margin is black on the anterior half; the spots on the third and fourth segments are widest at their middle.

Holotype, ♂, Banff, Alta., August 25, 1922, (C. B. Garrett); No. 502, in the Canadian National Collection, Ottawa.

Allotype, ♀, same data.

Paratypes, 9 ♂, 1 ♀, same data, 4 ♀, Banff, Sept. 15, 1922; 1 ♀, Banff, Sept. 15, 1922; all collected by C. B. D. Garrett. ♂ Banff, ♀ Banff, Aug. 1, 1906; and ♀ Banff, Aug. 8, 1911, collected by N. B. Sanson.

***Stratiomyia discaloides* new species.**

Allied to *discahis* Loew but the second ventral segment is black with a narrow basal and an interrupted apical fascia broadened at the sides to occupy practically the whole length of the segment, the legs are black pilose, the scutellum with decidedly less dense pile than the thorax, the face more receding, etc.

Length, 14 to 15 mm.; width of abdomen 7 to 8 mm. *Male.* Head entirely shining black. Pile pallid, more yellow on the face above, golden between the eyes, black on the ocellar triangle. Face receding, with a concavity at the upper fourth, the carina rather broad, rounded; slopes transversely rugulose, the sides, upper portion and cheeks more shining. Front with a deep, narrow longitudinal fovea. Eyes not quite touching, bare. Antennae black, last two joints opaque; third joint one-third longer than the first, second short; pile of first two joints black. Mouth parts brownish black, with yellow hairs.

Thorax and scutellum shining blue black, the latter with its margin inside the spines yellowish, but the apex in the middle black; spines moderately long,

sharp, yellow. Pile on the thorax yellowish greyish, dense on the dorsum, thin on its apex and on the scutellum.

Legs black; narrow apices of the femora, basal fourth of the tibiae and all the tarsi reddish yellow; tarsi brownish on the last two joints. Pile of femora black, elsewhere yellow.

Wings slightly infuscated; veins mostly olive luteous, a few brownish. Stigmal cell clearly defined, pallidly yellowish. Squamae brown with dense, long, whitish fringe. Halteres greenish, the base yellowish.

Abdomen shining blue black, with rather conspicuous black pile; on the sides of the second segment except anteriorly and on the lateral margin of the fourth and fifth and broad apex of the latter, whitish. First segment wholly black; second on the sides with a subquadrate yellow spot, distinctly broader behind, its longitudinal length distinctly greater than its width; side margins of the third segment on the basal half and a sub-oval or orbicular spot not quite touching the base except laterally, yellow; the narrow apex of the third and lateral margin of the fourth on the basal fourth, and similar but smaller markings on the incissures of the fourth and fifth, whitish yellow; a small roundish spot at the apex of the fifth segment. Venter black; narrow base of the second segment and a pair of transverse, narrowly interrupted, subtriangular spots occupying the entire length of the segment laterally, longitudinal subrectangular spots on the sides of the third, their inner ends rounded, and the narrow apices of the third and following segments, yellowish. Pile of the venter black, except on the yellow markings.

Female. Face more shining, as it is punctured rather than rugose on the slopes, the depression on the upper fourth absent; carina more rounded; front black, with a sub-cordate yellow spot below the ocelli; ground roughened by four or six broad, rather longitudinally placed, densely punctate depressions, polished across just above the antennae; ocellar triangle not prominent; occiput narrowly yellow along the eyes on the lower half. Pile wholly pale.

Abdomen with the sides of the third segment, expanding a little anteriorly and posteriorly, and the narrow sides of the fourth, extending narrowly inwards along its posterior margin, reddish yellow; fifth segment with a narrow median yellow line on its apical three-fourths and the narrow apex of the same colour.

Holotype, ♂, Chilcotin, British Columbia, June 4, 1920, (E. R. Buckell); No. 503, in the Canadian National Collection, Ottawa.

Allotype, ♀, Chilcotin, June 10, 1920, (E. R. Buckell).

Paratype, ♀, Kelowna, B. C., July 2, 1914, (M. H. Ruhman).

This species is very distinct from *discalis* and *quaternaria* and is most readily distinguished from both by the colour of the venter, pale markings, etc. The fringe on the squamae of the latter is less dense and there are patches of black hair on the thorax, the antennae are speckled with brownish and it is more compact and thicker. *S. discalis* is also more compact, the second ventral segment is wholly yellow, the margin of the scutellum usually all yellow and the first antennal segment longer, especially in the female. The arrangement of the veins about the stigmal area is also quite different.

Stratiomyia velutina new species.

Allied to *discoloides* but the pile is shorter, paler and much more dense on the dorsum of the thorax, the ventral yellow bands complete and slightly broader and the pile on the squamae not so abundant.

Length, 13 mm.; width of abdomen 6 to 6.5 mm. *Male*. Head shining black, with pallid greyish white pile, that between the eyes and on the occipital triangle black. Face receding, roundedly carinate. Antennae black, pile on the second segment golden brown and black.

Thorax and scutellum shining blue-black, the ground color almost obscured by the very dense, moderately short dirty whitish pile. Spines of the scutellum and a very short dash along the margin apically from their base, yellowish; spines moderately long and sharp. Wings as in *discoloides*. Squamae with the lower lobe more pale.

Abdomen almost as in *discoloides* but decidedly narrower and more convex, still less convex than in *discalis*. Yellow spot on the second segment, subtriangular, its inner side somewhat rounded, especially in front, the spots as wide posteriorly as long; spot on the third segment broadest sub-basally, one-third or less as wide as the preceding, gradually tapering, and extending narrowly inwards along the posterior margin for a short distance. There may be a linear angle on the posterior angle of the fourth and anterior lateral margin of the fifth segments. The narrow apex of the fifth emits a linear projection forward in the middle to about one-half the length of the segment, but in the paratype this is represented by an apical triangle which is very small. Pile black; basally and on the sides of the second and third segments, except the base of the former, sometimes on the whole side margin beyond the base of the second segment, and the moderately narrow or wide apex of the fifth segment, yellowish. Venter black, all the segments with conspicuous yellow apical bands, successively narrower towards the apical segment; sides of the second and third segments of the same colour, the third segment more broadly yellowish behind.

Holotype, ♂, Aspen Grove, British Columbia, June 15, 1922, (P. N. Vroom); No. 504, in Canadian National Collection, Ottawa.

Paratype, ♂, Lillooet, B. C., May 24, 1917, (A. W. A. Phair).

Pipiza atrata new species.

Entirely black pilose except the eyes and a few hairs on the femora basally.

Length 8 mm. *Male*. Face receding; shining metallic bluish black, thinly covered with whitish dust; with rather stout, abundant black pile; bluish black in ground colour. Vertical triangle and occiput shining black, with black pile. Eyes with brownish pile. Antennae black, third joint brownish, subcordate, longer below. Arista black.

Thorax and scutellum shining bluish black, with black pile. Squamae with white fringe.

Legs black; tips of all the femora, basal third of the anterior four and fifth of the hind tibiae and the extreme tips of the anterior four yellow. Tarsi brown, the tips and bases of the basitarsi very narrowly yellowish. Hind femora slightly thickened, without angular projection.

Wings hyaline, slightly yellowish in front; last section of fourth vein parallel to wing margin, straight.

Abdomen shining blue black; black pilose. Venter with long pale pile.

Holotype, ♂, Chilcotin, B. C., June 18, 1920, (E. R. Buckell); No. 505, in the Canadian National Collection, Ottawa.

This species is very distinct from all others known to me. It traces out to *nigripilosa* in my key (Proc. Cal. Acad. Sci. XI, 374) but is readily separated by the entire absence of brownish pile, broader, steel blue abdomen, and much shorter third antennal joint.

***Cnemodon nigricornis* new species.**

♂. Hind trochanters and middle coxae with processes; antennae wholly black; legs black, bases of tibiae narrowly and first two or three joints of front four tarsi yellow. ♀. Third antennal joint very large, oval, reddish below on basal half; pile of venter short, erect.

Length 5 mm. *Male*. Face evenly receding; black pilose on the sides and below, white pilose in the middle; frontal triangle rather large, moderately swollen, greenish black, with a greyish sheen, not opaque above; black pilose. Vertical triangle and occiput shining black; the former in front and the latter on the upper half black pilose, elsewhere yellowish or white pilose. Antennae wholly black; third joint a little longer than broad, longer below, the apex sub-truncate. Arista black. Eyes with short yellow or fulvous pile.

Thorax shining black, whitish pilose; pleura above and apical half of scutellum with brown or black pile.

Legs black; very narrow tips of the femora, narrow bases of the tibiae and the first three joints of the front four tarsi yellow; the front tarsi a little infuscated on the basal three joints. Middle tibiae gradually increasing in width to apical third, where it is suddenly narrowed; processes on hind trochanters rather short, of usual shape, pale on apical half.

Wings cinereous hyaline, last section of the fourth vein curved before basal third; last section of fifth vein almost straight.

Abdomen with the usual opaque and shining areas, and the usual arrangement of black and white pile.

Female. Face moderately wide, wholly white pilose, the orbits narrowly whitish pollinose, not expanding below the antennae, but continued to the lower third of the front where they expand slightly; front wide, black pilose on lower third and across the ocelli, elsewhere white with a yellow tinge. Posterior orbits with whitish pile and black ciliae. Antennae black; second joint on the inside and the third below on basal half, reddish yellow; third joint large, oval, the apex obtuse; arista black.

Thorax shining black; wholly white pilose. Squamae and halteres whitish. Wings hyaline, venation as in the male. Stigma pallidly yellowish.

Legs black; apices of the femora, broad bases and apices of the anterior four tibiae, narrow base of the hind ones, and first two joints of the anterior four tarsi, yellow. Pile wholly white. Middle tibiae broadened anteriorly.

Abdomen shining black; white pilose; narrow apical margins of the second and third segments with short black pile. Venter with sparse, short, erect white pile.

Holotype, ♂, Banff, Alberta, June 15, 1922 (C. B. Garrett); No. 506, in the Canadian National Collection, Ottawa.

Allotype, ♀, same data.

This species is related to *calcarata* and *elongata* to which it traces in my key, although it might possibly trace to *cevelata*. It differs from the two former by its wholly black antennae and wholly shining, slightly larger front, shorter processes on the hind femora, and pile on the upper portion of pleura and scutellum. From *cevelata* it is distinguished by the differently shaped trochantral processes, colour of pile on pleura, more slender form, etc. The large, broadly oval third antennal joint and wing venation are characteristic for the female, but identification of this sex is almost impossible. The female traces out to *placida* but is readily distinguished by the small frontal pollinose spots, larger antennae, etc.

***Dolichopus vanduzeei* new species.**

Length 3.5 to 4 mm.; of wings, the same. *Male*. Face moderately narrow; a little wider above; brownish yellow: Front green or green blue, the sides bronze. Antennae wholly black; third joint twice as long as broad, the apex rather acute; arista situated well before the apex. Orbital ciliae wholly black.

Thorax green, not much shining, the dorsum with a longitudinal darker geminate stripe; in front thinly greyish pruinose. Pleura greyish pruinose. Abdomen green with bronze reflections, the sides noticeably greyish pruinose. Hypopygium black; lamellae brownish grey, the border black; triangular, as broad as long, the apex with about six teeth, the lower ones larger, with fine black hairs above and below. Coxae black, the front ones with yellowish grey pollen and black hairs on their anterior surface. All the femora black, their apices yellow; hind ones not ciliate below; middle and hind femora each with two preapical bristles in front. All the tibiae yellowish, the apical sixth of the hind ones brown or black, middle ones with one bristle below, near the apical third. Tarsi black, the front four basitarsi more than half yellow; middle basitarsi without a bristle above. Ciliae of colypteres black.

Wings greyish hyaline; last section of the fourth vein with a slight curve beyond the basal third; costa with an elongate tapering swelling at the tip of the first vein. Hind margin scarcely notched at tip of fifth vein, almost rounded.

Female. Face wide; greyish on the lower half, yellow above; sometimes wholly ochreous. Third antennal segment only a little longer than broad, the arista almost apical; abdomen more inclined to be cupreous bronzed.

Holotype, ♂, Banff, Alberta, May 5, 1922 (C. B. D. Garrett); No. 507, in the Canadian National Collection, Ottawa.

Allotype, ♀, same data.

Paratypes, 8 ♂, 2 ♀, same data; 1 ♀, Aug. 1, 1922, same locality and collector.

The male of this species traces out between *intentus* and *gratus* in the Van Duzee, Cole and Aldrich key. It is distinguished from *intentus* by its ochreous face and from *gratus* by the long third antennal joint. The female traces out to *nubifer* in the same key, but that species has a white face as has also the female of *gratus*. Legs wholly simple.

I take pleasure in naming this species in honour of Mr. M. C. Van Duzee.

***Dolichopus albertensis* new species.**

Length almost 5 mm., wing 4.5 mm. *Male*. Face rather narrow, a little wider above, white. Front bluish green to blue not strongly shining, the sides narrowly opaque. Antennae wholly black, third joint short oval, its apex narrower, more pointed above, the arista inserted beyond the middle, bare. Proboscis and palpi brown, the edge of the former usually narrowly yellowish. Orbital ciliae wholly black.

Thorax deep green, not very shining, with four more or less distinct, narrow eupreous lines, sometimes with a slight bronze reflection. Pleura brighter green, more brassy, the metapleura blackish, thinly covered with greyish white pollen. Abdomen greenish with a brassy reflection, incisures darker, first two segments sometimes bluish, their bases laterally darker, purplish brown. Hair all black. Hypopygium black; lamellae black, excluding the stem, rather square, its apex jagged; with four short teeth, wholly fringed with sparse, rather long stout hairs.

Legs simple; wholly black, the knees very narrowly yellowish, the extreme apex of the front tibiae sometimes yellowish. Front coxae on their anterior surface with whitish luteous pollen and black hairs which are rather long. Middle and hind femora each with two preapical bristles, the latter not ciliate but with a row of conspicuous black hairs on the lower inner edge on the basal half or more and with slightly longer hairs on the lower outer edge. Hind tibiae a little stout; on the under side with a row of short, rather stout black hairs ending at the long bristle; hair on all the tibiae wholly black. Fore tarsi a little longer than their tibiae, the first joint about equal in length to the three following, the last segment slightly longer than the fourth. Middle basitarsi without a bristle above. Calypters and halteres yellow, the ciliae of the former black, abundant.

Wings greyish hyaline, the costa a little swollen before the tip of the first vein, hind margin conspicuously indented at the tip of the fifth vein; a shallow sinus between the fifth and sixth veins, the anal angle a little prominent.

Female. Face broader, silvery white; third antennal joint slightly shorter. Front darker, sometimes bluish. Abdomen usually with bronze reflections.

Holotype, ♂, Banff, Alta., June 18, 1922, (C. B. D. Garrett); No. 508, in the Canadian National Collection, Ottawa.

Allotype, ♀, same data.

Paratypes, 6 ♂, 5 ♀, same data; 1 ♀, Banff, Alta., July 8, 1922, (C.B.D. Garrett).

This species is related to *D. barbaricus*, but is readily distinguished by the bright coloured pleura, absence of long hairs on the lower, inner side of the hind femora, bluish green front, and absence of brownish colour just below the antennae. The male hypopygium appears to differ in shape. Differs from *D. picipes* of Europe in that the venter is not grayish and in the presence of a costal swelling.

***Dolichopus diversipennis* new species.**

Length almost 6 mm.; of wing the same. *Male*. Face wide, slightly narrower below; dull golden brownish. Front deep shining blue, the middle violet. Antennae wholly black, the first joint shining, second and third sub-shining;

third joint orbicular, its upper apex pointed, apparently a little broader than long; arista inserted a little before the apex of the third joint, the basal portion over one-third as long as the apical joint. Orbital ciliae black, those on the lower half pale yellow.

Thorax deep green with a brownish cast; a geminate median longitudinal brownish stripe. Pleura and anterior of the dorsum with greyish pollen, the pleura brighter green than the dorsum, with more or less bronze reflection. Abdomen green, with bronze reflections, the sides thinly whitish pollinose. Hypopygium black, with thin whitish dust; lamellae large, elongate oval, the lower apex angular, the upper broadly rounded, in colour dirty yellowish, the border black, the apex jagged, with six rather long projections. Legs simple. All the coxae black, with grey pruinosity, the anterior surface of the front pair with short black hairs. Front femora black, about the apical sixth yellow; middle and hind femora reddish yellow, the former with a ventral black streak on the basal half, the latter with a similar streak on the basal third and the apical fifth, not meeting below, black; with a greyish pruinosity. Tibiae yellow, the middle ones a little swollen apically, the hind ones rather stout, their apical fifth black. Fore tarsi plain. All the tarsi black, the front four metatarsi reddish yellow except their apices. First joint almost as long as the remainder combined, the fourth and fifth joints of equal length. Middle and hind femora each with three preapical bristles in front; the latter with long black ciliae which are longer than the greatest width of the femora. Middle tibiae with one bristle below. Middle basitarsi without a bristle above. Calypters and halteres yellow, the former with abundant, long black ciliae.

Wings hyaline, with a diffuse brown spot beyond the crossvein between the fourth vein and the costa and narrowly on the crossvein, the spot darkest between the costa and third vein. Costa with a conspicuous elongate enlargement before the tip of the first vein, gradually narrowing beyond the vein. Last section of fourth vein moderately bent at its basal third, the third vein curving noticeably towards it apically. Hind margin a little indented at tip of fifth vein, scarcely, broadly so at tip of sixth.

Holotype, ♂, Nordegg, Alberta, July 5, 1921, (J. H. McDunnough); No. 509, in the Canadian National Collection, Ottawa.

This species must be very close to *D. partitus*, but may be distinguished by the more extensively yellow legs, the broader, more pointed antennae, the broader lamellae, which are more squarish basally and the costal swelling which seems to be a little larger. In Van Duzee, Cole and Aldrich's Key it traces out to *bryanti*, but is readily distinguished by the maculated wings.

A NEW WESTERN CATOCALA (LEPID.)*

BY J. MCDUNNOUGH,

Ottawa, Ont.

For the past few years we have been receiving considerable material in this group of moths from our Lethbridge laboratory; besides *verecunda* Hlst., occasional specimens of the Albertan form of *pura* (which incidentally is intermediate between Eastern *semirelecta* and typical *pura*) and an odd *unijuga*, the sendings were largely made up of specimens which I fail to place under any known name; they approach closest to *meskei* Grt. and may eventually prove to be a race of this species. Until, however, we know the life histories of both species more fully, I propose to treat it as a new species with description as follows:—

Catocala orion n. sp.

Thorax and primaries a pale bluish gray, shaded considerably with blackish; the latter rather narrow and with the dark shading most evident at the base of the wing in the submedian area, around the reniform, between the t.p. and s.t. lines and as an oblique dash below apex of wing. Basal half line black, forming small patch on costa; t.a. line geminate, white filled, very irregularly dentate, with deep inward angulations on cubitus and vein 1; beyond it on costal portion of wing an oblique whitish shade including the subreniform; reniform of usual shape, lunate, with outer margin somewhat dentate; t.p. line black, bordered outwardly with white, very strongly dentate with a prominent reentrant angle on vein 1; subterminal space slightly tinged with brown but mostly obscured by dark shading; s.t. line white, strongly dentate, bordered outwardly by blackish, subparallel to t.p. line, the black ends of the teeth at times almost touch the broken black terminal line; fringes pale, marked at ends of veins by black. Secondaries pale pinkish-red, much as in *meskei*, with the usual dark median and terminal bands, the former not attaining anal margin of wing, latter enclosing a flesh colored apical spot and slight pale spots along termen of wing, which give the outer margin of band a crenulate appearance; fringes whitish. Expanse 65—70 mm.

Holotype—♂, Lethbridge, Alta., Aug. 31, (H. L. Seamans); No. 550 in the Canadian National Collection, Ottawa.

Allotype—♀, same locality, Aug. 25, in the Canadian National Collection, Ottawa.

Paratypes—2♂, 2♀, same locality, in Canadian National Collection, Ottawa.

As is so often the case in this group the species occurs in two forms; the typical form, as above described, has rather contrasted maculation of primaries with a more or less evident dark shade through the submedian fold; in the second form the dark shading is obsolescent and the primaries are rather even blue-gray with less contrasted maculation. For this form the name **concolorata** may be used; the types, No. 551, in the Canadian National Collection, are six specimens (3♂, 3♀) from Lethbridge, bred or captured on various dates in August.

Mr. Seamans informs us that the larva feeds on cottonwood and is deep gray in color with well-marked subdorsal and lateral dark bands.

* Contribution from the Entomological Branch, Dept. of Agric., Ottawa.

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